

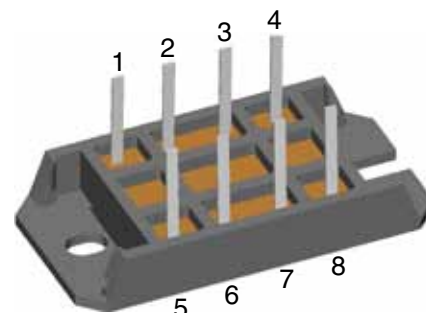
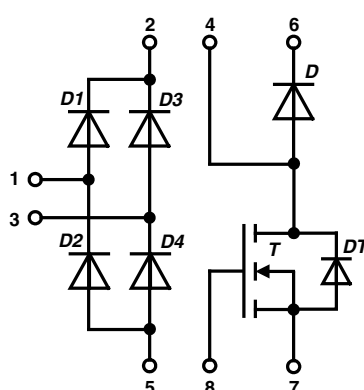
Power MOSFET Stage for Boost Converters

Module for Power Factor Correction

Single Phase Rectifier	Boost Diode	MOSFET
$V_{RRM} = 1600 \text{ V}$	$V_{RRM} = 600 \text{ V}$	$V_{DSS} = 600 \text{ V}$
$I_{DAV} = 106 \text{ A}$	$I_{F25} = 60 \text{ A}$	$I_{D25} = 50 \text{ A}$
$I_{FSM} = 300 \text{ A}$	$V_F(30A) = 2.24 \text{ V}$	$R_{DS(on)} = 120 \text{ m}\Omega$

Part name (Marking on product)

VUM33-06PH



Features:

- Package with DCB ceramic base plate
- Soldering connections for PCB mounting
- Isolation voltage 3600 V~
- Low $R_{DS(on)}$ Polar™ MOSFET
- Low package inductance for high speed switching
- SONIC™ boost diode
 - fast and soft reverse recovery
 - low operating forward voltage

Advantages:

- 3 functions in one package
- Output power up to 8 kW
- No external isolation
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- Fits easily to all available PFC controller ICs

Package:

- "V1-Pack" standard outline
- Insulated copper base plate

Application:

- Power factor pre-conditioner for SMPS, UPS, battery chargers and inverters
- Boost topology for SMPS including 1~ rectifier bridge
- Power supply for welding equipment

MOSFET T

Symbol	Definitions	Conditions	min.	Ratings			Unit
				typ.	max.		
V_{DSS}	drain source voltage	$T_{VJ} = 25^{\circ}\text{C}$			600		V
V_{GSS}	max. DC gate voltage	continuous			± 20		V
V_{GSM}	max. transient gate source voltage	transient			± 30		V
I_{D25}	drain current	$T_C = 25^{\circ}\text{C}$			50		A
I_{D80}		$T_C = 80^{\circ}\text{C}$			37		A
P_{tot}	total power dissipation	$T_C = 80^{\circ}\text{C}$			500		W
$R_{DS(on)}$	drain source on resistance	$I_D = 30\text{ A}; V_{GE} = 10\text{ V}$			120		m Ω
					240		m Ω
$V_{GS(th)}$	gate source threshold voltage	$I_C = 8\text{ mA}; V_{DS} = V_{GS}$	$T_{VJ} = 25^{\circ}\text{C}$	2.5	5.0		V
I_{DSS}	drain source leakage current	$V_{DS} = V_{DSS}; V_{GS} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		50		μA
			$T_{VJ} = 125^{\circ}\text{C}$		500		μA
I_{GSS}	gate source leakage current	$V_{GS} = \pm 20\text{ V}; V_{DS} = 0\text{ V}$			± 500		nA
C_{iss}	input capacitance	$V_{DS} = 25\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz}$		8.0			nF
$Q_{G(on)}$	total gate charge	$V_{DS} = 300\text{ V}; V_{GS} = 10\text{ V}; I_D = 50\text{ A}$		165			nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{DS} = 380\text{ V}; I_D = 20\text{ A}$ $V_{GS} = 0/10\text{ V}; R_G = 4.7\text{ }\Omega$ $R_{G\text{ eff}} = 5.5\text{ }\Omega$ ¹⁾	$T_{VJ} = 25^{\circ}\text{C}$	56			ns
t_r	current rise time			12			ns
$t_{d(off)}$	turn-off delay time			110			ns
t_f	current fall time			12			ns
E_{on}	turn-on energy per pulse			0.3			mJ
E_{off}	turn-off energy per pulse			0.16			mJ
$t_{d(on)}$	turn-on delay time	inductive load $V_{DS} = 380\text{ V}; I_D = 20\text{ A}$ $V_{GS} = 0/10\text{ V}; R_G = 4.7\text{ }\Omega$ $R_{G\text{ eff}} = 5.5\text{ }\Omega$ ¹⁾	$T_{VJ} = 125^{\circ}\text{C}$	56			ns
t_r	current rise time			16			ns
$t_{d(off)}$	turn-off delay time			144			ns
t_f	current fall time			14			ns
E_{on}	turn-on energy per pulse			0.47			mJ
E_{off}	turn-off energy per pulse			0.20			mJ
R_{thJC}	thermal resistance junction to case	with heat transfer paste (IXYS test setup)			0.14		K/W
R_{thJH}	thermal resistance case to heatsink			0.18	0.24		K/W

¹⁾ $R_{G\text{ eff}}$ includes the driver resistance of 0.8 Ω

Boost Diode D

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			600	V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			60	A
I_{F80}		$T_C = 80^{\circ}\text{C}$			40	A
V_F	forward voltage	$I_F = 30\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		2.24 2.19	V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		30 2	μA mA
Q_{rr}	reverse recovery charge	$V_R = 380\text{ V}$ $di_F/dt = -790\text{ A}/\mu\text{s}$ ²⁾ $I_F = 20\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$	0.24		μC
I_{RM}	max. reverse recovery current			11.7		A
t_{rr}	reverse recovery time			43		ns
E_{rec}	reverse recovery energy			0.026		mJ
Q_{rr}	reverse recovery charge	$V_R = 380\text{ V}$ $di_F/dt = -700\text{ A}/\mu\text{s}$ ²⁾ $I_F = 20\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$	0.59		μC
I_{RM}	max. reverse recovery current			15.9		A
t_{rr}	reverse recovery time			55		ns
E_{rec}	reverse recovery energy			0.076		mJ
R_{thJC}	thermal resistance junction to case	with heat transfer paste (IXYS test setup)		0.84	0.72	K/W
R_{thJH}	thermal resistance case to heatsink				0.96	K/W

²⁾ Test setup: MOSFET T driven with $R_{G\text{eff}} = 5.5\ \Omega$ and $V_{GS} = 0/10\text{ V}$

Input Rectifier Bridge D1 - D4

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1600	V
I_{DAV}	average forward output current	sine 180°	$T_C = 80^{\circ}\text{C}$		106	A
I_{FAVM}	max. average forward current (per diode)	rect.; $d = 0.5$	$T_C = 80^{\circ}\text{C}$		57	A
I_{F25}	forward current	DC	$T_C = 25^{\circ}\text{C}$		106	A
I_{F80}	forward current	DC	$T_C = 80^{\circ}\text{C}$		71.5	A
I_{FSM}	max. forward surge current	$t = 10\text{ ms}; \text{ sine } 50\text{ Hz}$	$T_{VJ} = 45^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		300 170	A A
I^2t	I^2t value for fusing	$t = 10\text{ ms}; \text{ sine } 50\text{ Hz}$	$T_{VJ} = 45^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		450 240	A^2s A^2s
P_{tot}	total power dissipation	$T_C = 80^{\circ}\text{C}$			110	W
V_F	forward voltage	$I_F = 50\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$		1.39 1.39	V V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$		20 1.5	μA mA
R_{thJC}	thermal resistance junction to case	(per diode)		0.72	0.64	K/W
R_{thJH}	thermal resistance case to heatsink	with heat transfer paste (IXYS test setup)			0.85	K/W

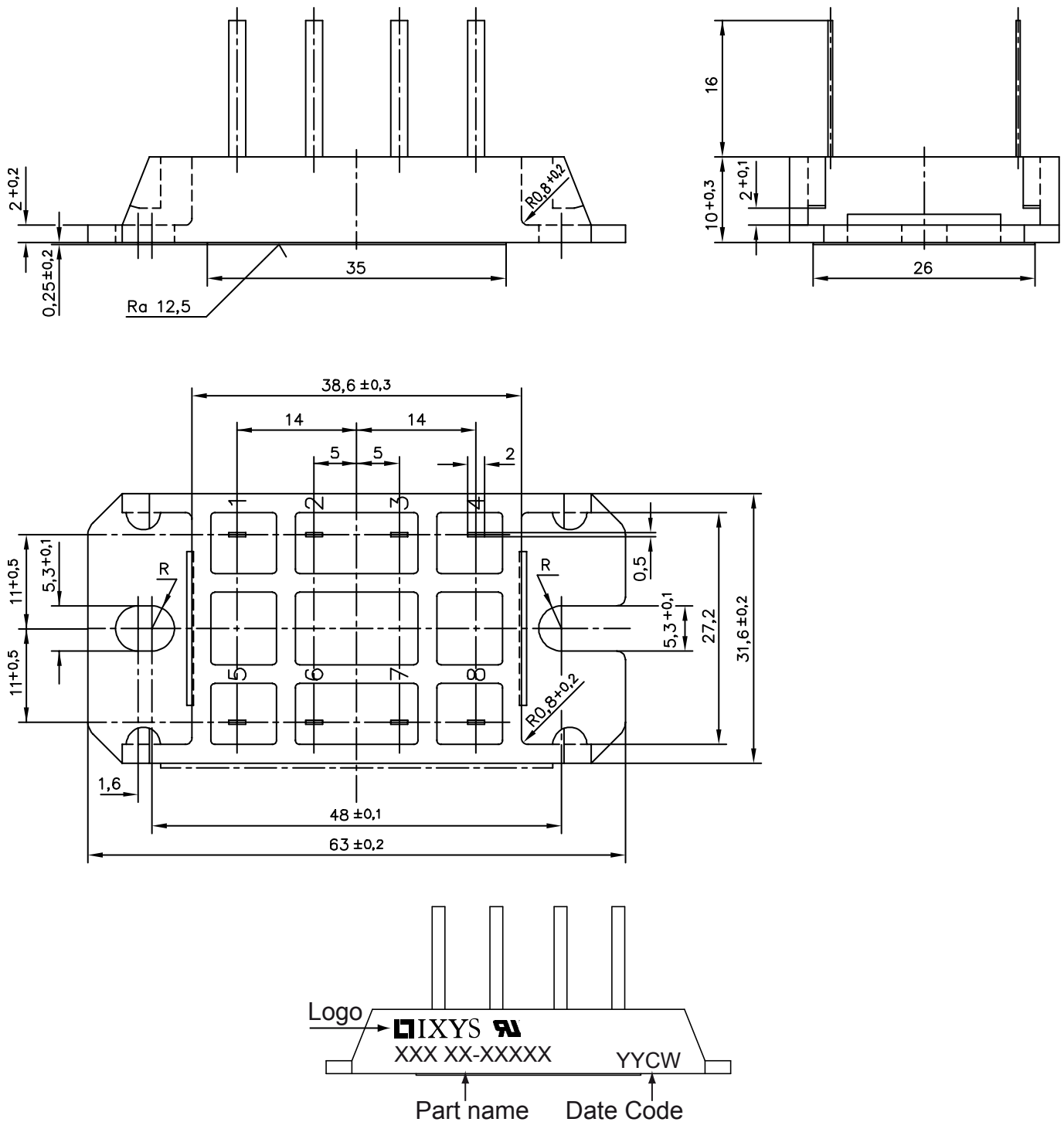
Module

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
T_{VJ}	operating temperature		-40		150	$^{\circ}\text{C}$
T_{VJM}	max. virtual junction temperature		-40		150	$^{\circ}\text{C}$
T_{stg}	storage temperature		-40		125	$^{\circ}\text{C}$
V_{ISOL}	isolation voltage	$I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz}; 1\text{ sec.}$			3600	V~
M_d	mounting torque (M5)		2		2.5	Nm
Weight				35		g

$T_C = 25^{\circ}\text{C}$ unless otherwise stated

Outline Drawing

Dimensions in mm (1 mm = 0.0394")


Product Ordering

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	VUM 33-06PH	VUM 33-06PH	Box	10	508843

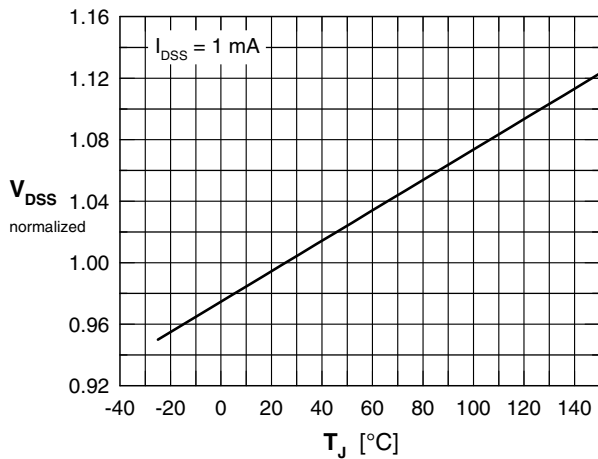


Fig. 1 Drain source breakdown voltage V_{DSS} versus junction temperature

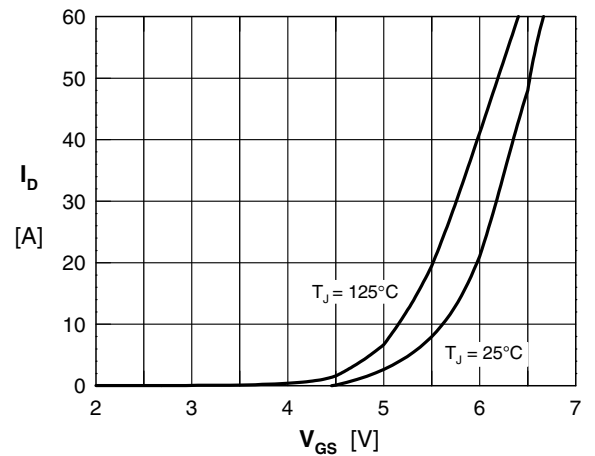


Fig. 2 Typical transfer characteristics

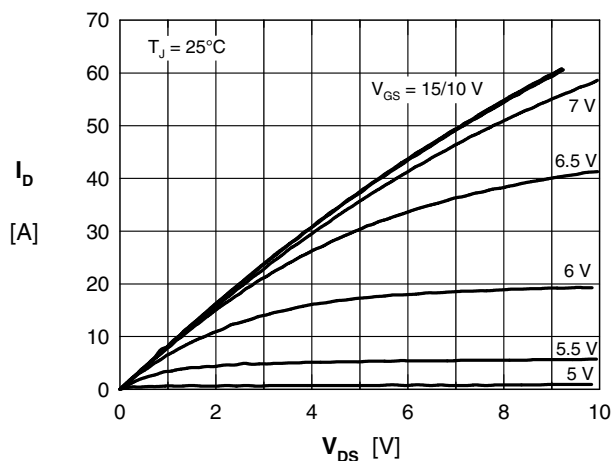


Fig. 3 Typical output characteristics

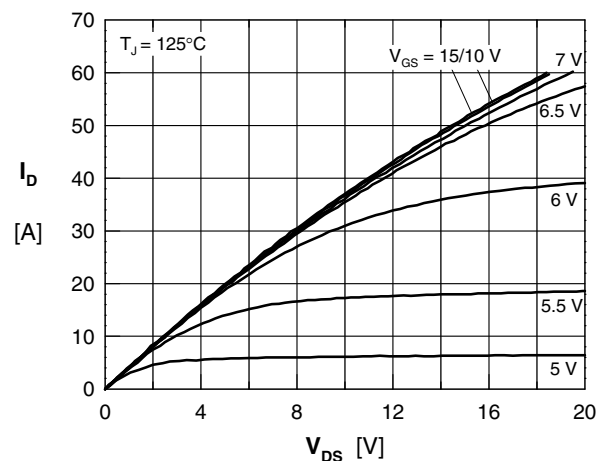


Fig. 4 Typical output characteristics

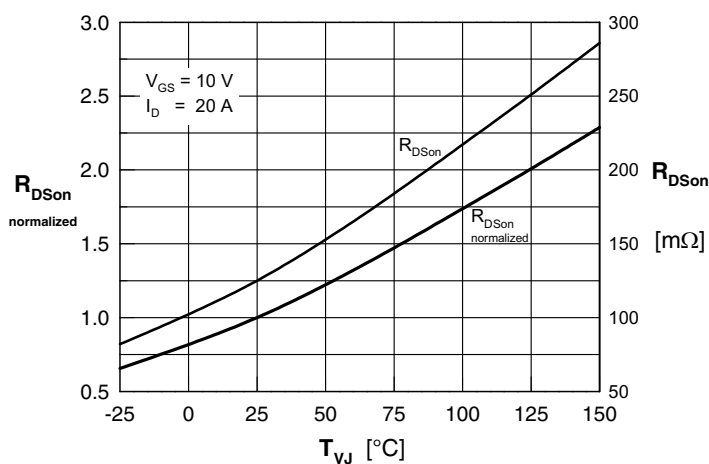


Fig. 5 Drain source on-state resistance $R_{DS(on)}$ versus junction temperature

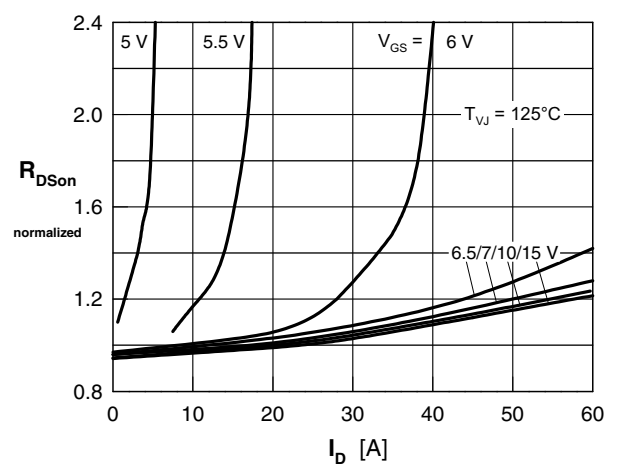


Fig. 6 Drain source on-state resistance $R_{DS(on)}$ versus I_D normalized to $R_{DS(on)}$ at $V_{GS} = 10 \text{ V}$ and $I_D = 20 \text{ A}$

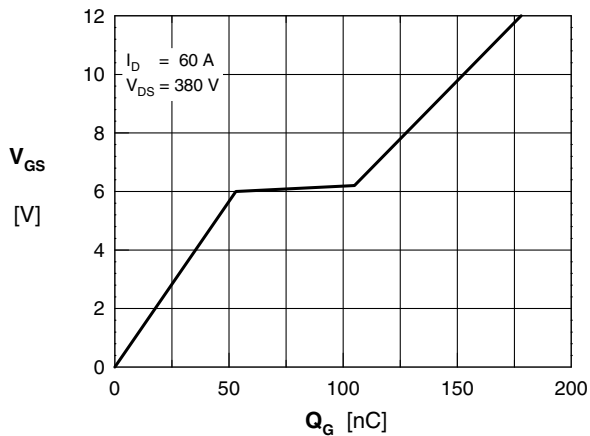


Fig. 7 Gate charge characteristics

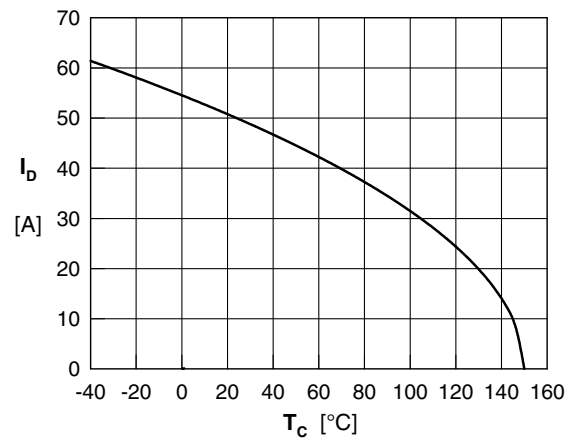


Fig. 8 Drain current I_D versus case temperature T_C

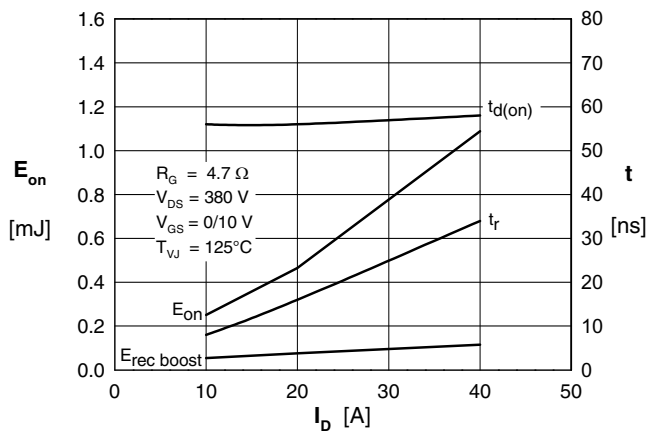


Fig. 9 Typ. turn-on energy and switching times versus drain current, inductive switching

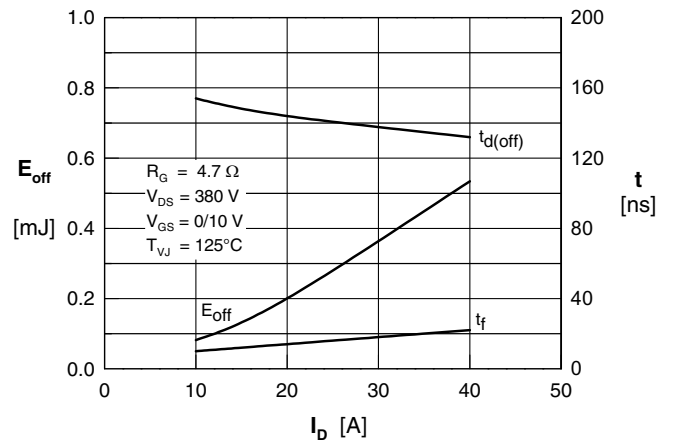


Fig. 10 Typ. turn-off energy and switching times versus drain current, inductive switching

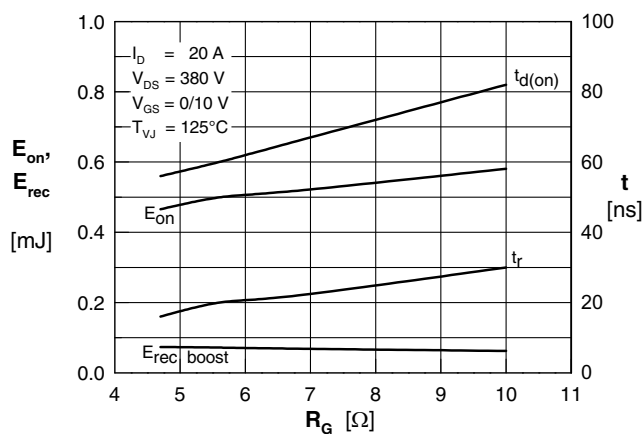


Fig. 11 Typ. turn-on energy and switching times versus gate resistor, inductive switching

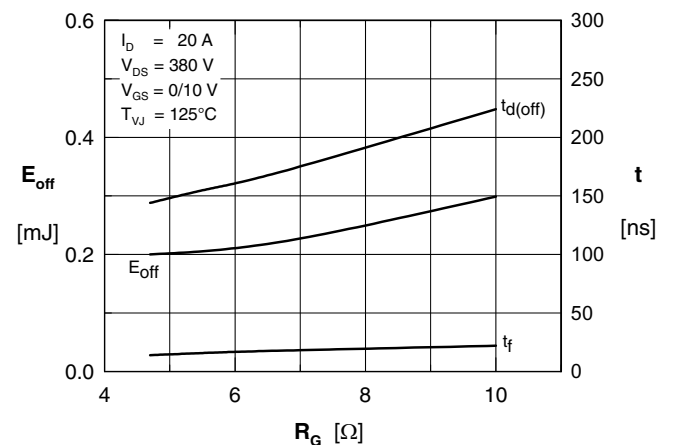
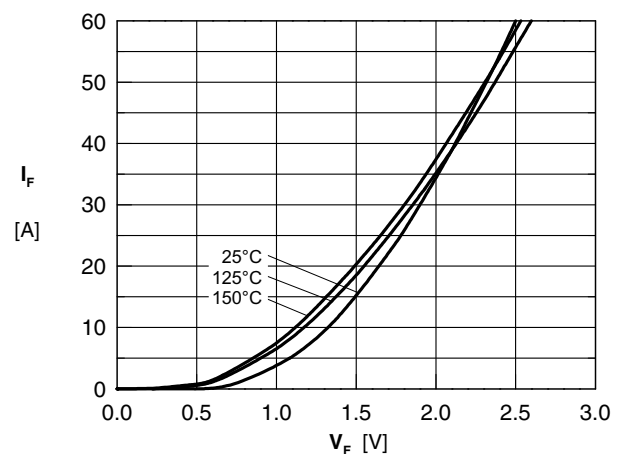
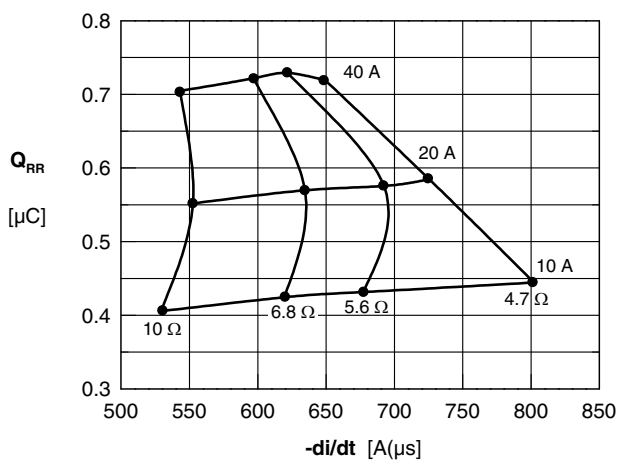
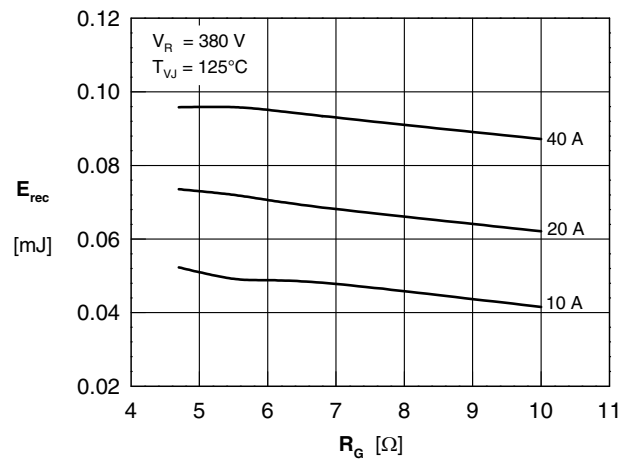
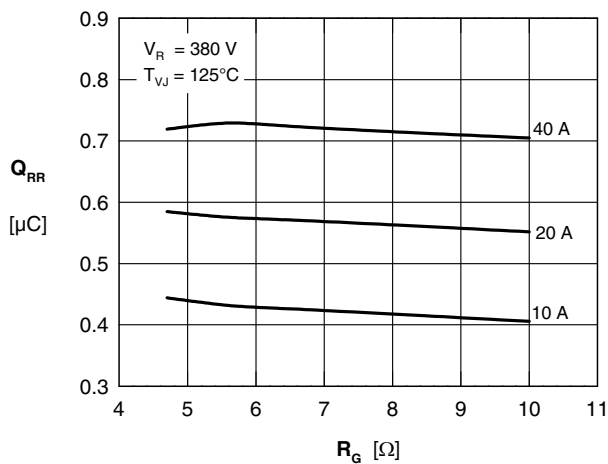
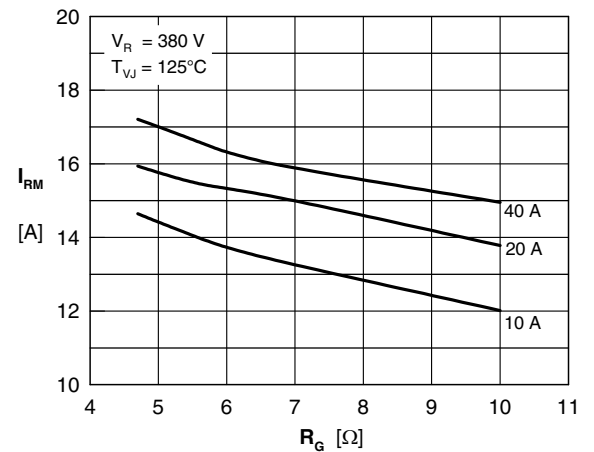
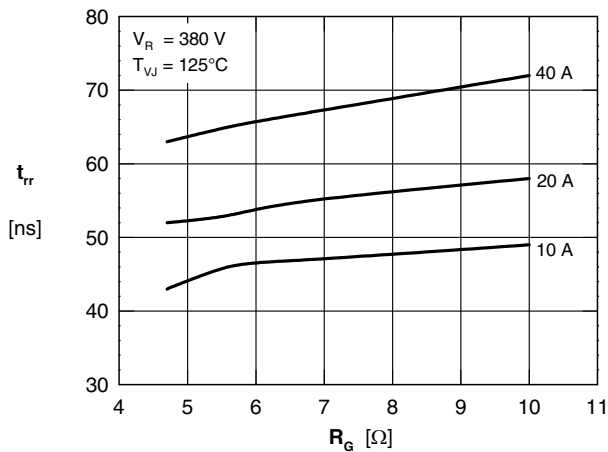


Fig. 12 Typ. turn-off energy and switching times versus gate resistor, inductive switching



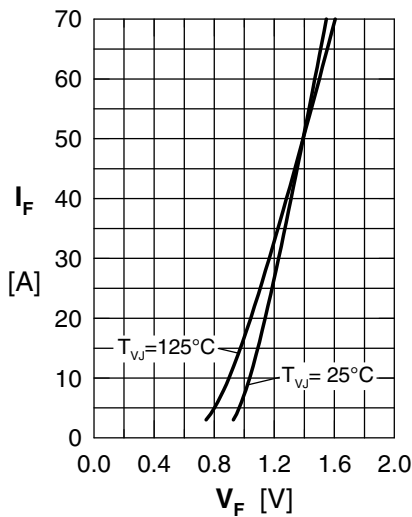


Fig. 19 Forward current vs. voltage drop of input rectifier diode

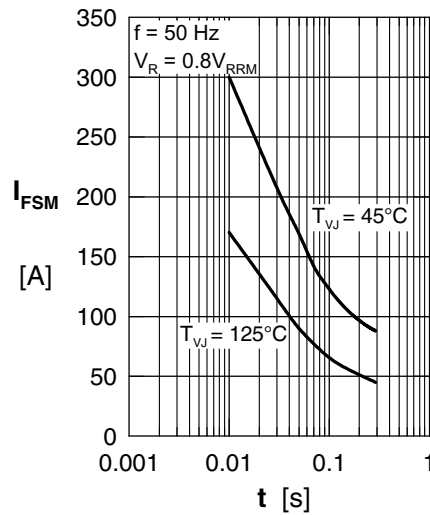


Fig. 20 Non-repetitive peak surge current (Rectifier Diodes)

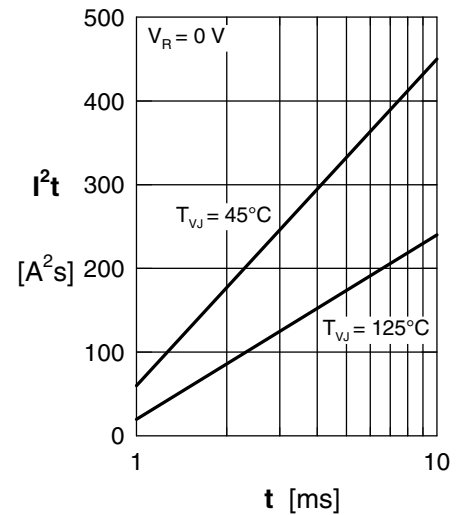


Fig. 21 I^2t for fusing (Rectifier Diodes)

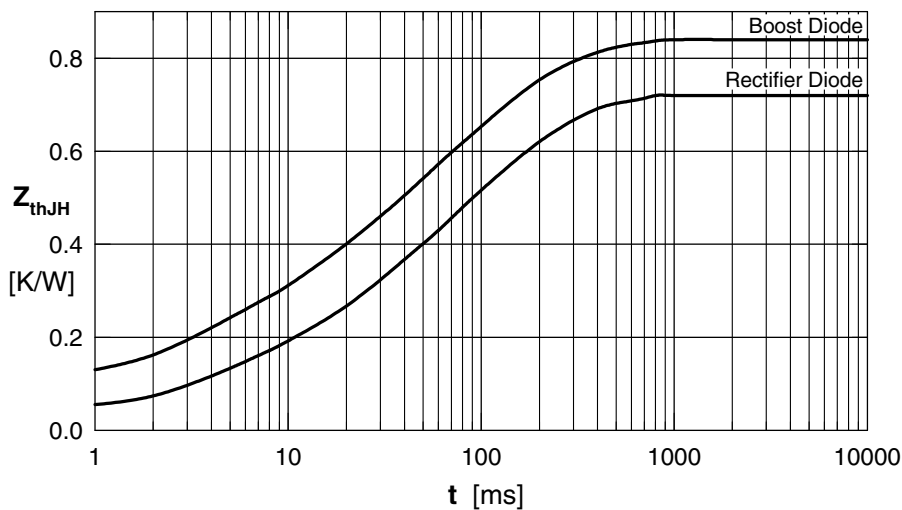


Fig. 22 Typ. transient thermal impedances of Boost Diode and Rectifier Diode

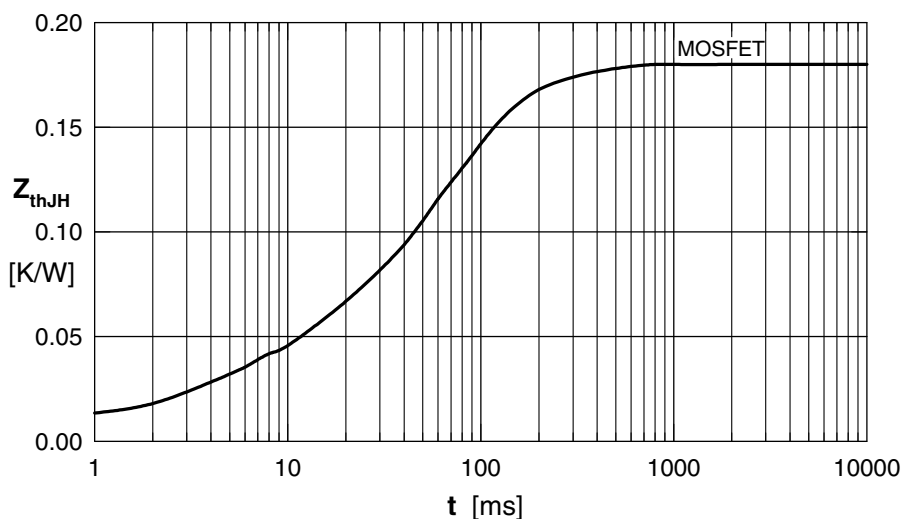


Fig. 23 Typ. transient thermal impedances of MOSFET